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Abstract

Self-Healing Potential of Geopolymer Concrete †

Magdalena Rajczakowska *, Karin Habermehl-Cwirzen, Hans Hedlund and Andrzej Cwirzen

Building Materials, Department of Civil, Environmental and Natural Resources Engineering, 97871 Luleå, Sweden; karin.habermehl-cwirzen@ltu.se (K.H.-C.); hans.hedlund@ltu.se (H.H.); andrzej.cwirzen@ltu.se (A.C.)

* Correspondence: magdalena.rajczakowska@ltu.se

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Abstract: Waste management is emerging as one of the most troublesome and critical problems of the upcoming decades. Therefore, the utilization of industrial by-products as building materials components has been widely studied in recent years. Geopolymer concrete, with binder entirely substituted by slag or fly ash, is one of the materials, which combines positive environmental impact with satisfying mechanical parameters. Although various properties of geopolymers have been examined, the autogeneous self-healing potential of this alternative binder has not been thoroughly verified yet. This paper aims to validate whether geopolymer concrete made of alkali activated slag is capable of self-repair. Four different mortar mixes with two types of slag and varying activation parameters were investigated. The polyvinyl alcohol (PVA) fibers were added in order to control the crack width. The 1.2 × 1.2 × 6 cm beams were pre-cracked with the use of three point bending test at 7 days after casting to achieve crack opening of approximately 300 μm. The effects of various exposure conditions on the healing process were examined, i.e., lime water, different sodium silicate solutions and water. The self-healing efficiency as well as the evolution of the crack recovery was assessed by the observation of the crack surface with the use of digital optical microscope. The healed area of the crack was calculated and compared for all the specimens by applying the image processing techniques. The morphology of the healing products as well as their chemical composition were examined with the use of Scanning Electron Microscope with Energy Dispersive Spectroscopy.

Keywords: autogeneous self-healing; cementitious materials; alkali activation; cracking